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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

ANNUAL MEETING AT CLEVELAND, OHIO, SEPTEMBER 11–16, 1944

By Dr. F. R. MOULTON
PERMANENT SECRETARY

AFTER cancelling meetings for two years on request of the Office of Defense Transportation because of transportation difficulties, the association will hold its annual meeting for 1944 in Cleveland, Ohio, from September 11 to September 16, inclusive. All affiliated and associated societies have been invited to participate in the meeting so far as it may be possible for them to do so. If transportation conditions are favorable, the meeting will be well attended; if there are serious traffic congestions in September, it will be streamlined to the extent that may be necessary.

September was chosen as the time for the meeting, first, because the holiday seasons must be avoided, and, second, because for at least some colleges and universities this is an open period between sessions. In particular, it is the week at Case School of Applied Science between the departure of one group of trainees and the arrival of another group, and it is the week between the summer and autumn sessions at Western Reserve University. Since Case School of Applied Science will provide several meeting rooms and Western Reserve University a large number, this consideration is very important. After the close of the war annual meetings of the association will be held again at the Christmas holiday season or perhaps at some other time that may be more advantageous. Such questions will be open for consideration after the Cleveland meeting.

Cleveland was chosen for the place of meeting because it is about the only city in the country that now

can provide 40 to 50 rooms for simultaneous sessions and accommodations for a large convention. Dr. William E. Wickenden, president of Case School of Applied Science, will be chairman of the General Committee for the meeting. Western Reserve University will make its facilities available to the association and its affiliated societies. The Scientific Exhibition and the general registration will be in the arena of the Cleveland Auditorium.

Two conferences of the secretaries of the sections and affiliated societies were held for the purpose of discussing general policies to be followed in organizing programs for meetings of the association and its affiliated societies. Secretaries of sections and of affiliated societies who live in the Middle West met in Chicago on February 13; those living in the East met in New York on February 20. The following named secretaries and officers of the association attended the Chicago conference:

W. A. Albrecht (University of Missouri), secretary of the section on agriculture.

C. C. Allison (The Ohio State University), secretary of the American Phytopathological Society.

A. J. Carlson (The University of Chicago), president of the American Association for the Advancement of Science.

L. V. Domm (The University of Chicago), secretary of the American Society of Zoologists.

William A. Dreyer (University of Cincinnati), secretary of the Ecological Society of America.

Neil E. Gordon (Wayne University), secretary of the section on chemistry.

Glenn L. Jenkins (Purdue University), chairman of the subsection on pharmacy.

A. C. Kinsey (Indiana University), secretary of the American Society of Naturalists.

Paul C. Kitchin (The Ohio State University), secretary of the subsection on dentistry.

W. M. Krogman (The University of Chicago), secretary of the section on anthropology.

D. H. Leavens (The University of Chicago), representative of the Econometric Society.

George W. Martin (State University of Iowa), secretary of the section on botanical sciences.

C. E. Mickel (University of Minnesota), president of the Entomological Society of America.

F. R. Moulton (Smithsonian Institution Building, Washington), permanent secretary of the association.

Orlando Park (Northwestern University), president of the Ecological Society of America.

H. H. Remmers (Purdue University), secretary of the section on education.

H. H. Ross (University of Illinois), secretary of the Entomological Society of America.

L. H. Snyder (The Ohio State University), secretary of the Genetics Society of America.

E. C. Stakman (University of Minnesota), member of the Executive Committee.

L. H. Tiffany (Northwestern University), representative of the Limnological Society of America.

Sam Woodley (Smithsonian Institution Building, Washington), assistant secretary of the association.

C. C. Wylie (State University of Iowa), secretary of the section on astronomy.

The following named secretaries and officers of the association attended the New York conference:

Paul R. Burkholder (Yale University), secretary of the Botanical Society of America.

O. W. Caldwell (Boyce Thompson Institute for Plant Research), general secretary of the association.

A. J. Carlson (The University of Chicago), president of the association.

Frank D. Carvin (Newark College of Engineering), secretary of the section on engineering.

E. N. Cory (University of Maryland), secretary of the American Association of Economic Entomologists.

J. T. Culbertson (Columbia University), secretary of the American Society of Parasitologists.

L. K. Frank (New York Academy of Medicine), guest.

E. P. Hutchinson (U. S. Department of Justice, Philadelphia), secretary of the section on social and economic sciences.

E. S. Johnston (Smithsonian Institution Building, Washington), secretary of the American Society of Plant Physiologists.

J. R. Kline (University of Pennsylvania), secretary of the American Mathematical Society.

Burton E. Livingston (Riderwood, Maryland), chairman of the Executive Committee.

F. R. Moulton (Smithsonian Institution Building, Washington), permanent secretary of the association.

Gardner Murphy (College of the City of New York), guest.

R. J. Seeger (U. S. Navy Department, Washington), secretary of the section on historical and philological sciences.

G. A. Stetson (Engineering Societies Building, New York City), editor of the American Society of Mechanical Engineers.

A. C. Swinnerton (Signal Corps, U. S. War Department), secretary of the section on geology and geography.

H. B. Tukey (New York State College Experiment Station, Geneva), secretary of the American Society for Horticultural Science.

Sam Woodley (Smithsonian Institution Building), assistant secretary of the association.

These conferences were not concerned primarily with the numerous administrative details that must be given attention in preparation for a great meeting of many sections and societies. Instead, they were almost entirely devoted to such fundamental questions as the relations and obligations of science to the future of civilization, the purposes of scientific meetings, the interrelations among various sciences and between the natural and the social sciences, the value both of re-

ports of special researches and of syntheses of broad fields of science, and the importance of placing the methods and spirit of science, as well as its results, before the general public. Such discussions lead first to attitudes of mind rather than to specific actions, yet a few resolutions were passed by both conferences. The principal one passed by the Chicago conference was the following:

Resolved, that this conference recommend that the fundamental nature of science, its relations and obligations to society, together with the means of securing public comprehension of the scientific method and attitudes, be considered as subjects to be stressed in the September meeting, both in general sessions and in symposia and, as may seem desirable, in the meetings of the individual sections and societies.

This resolution was approved at the New York conference. As a first step toward putting it into effect, the secretaries of three affiliated societies, Dr. Paul R. Burkholder, secretary of the Botanical Society of America, Dr. Earl S. Johnston, secretary of the American Society of Plant Physiologists, and Dr. H. B. Tukey, secretary of the American Society for Horticultural Science, at the close of the meeting promptly went into a huddle to consider what joint programs their societies might advantageously organize. Evidently it will require much cooperative work and experimentation to increase the number and improve the quality of programs of the type that was proposed. In recognition of this fact the Chicago conference passed a supplementary resolution to the effect that the "sections and societies continually study ways and means of more effective organization and presentation of their programs at annual meetings."

In the course of the discussions it was suggested that it might be advantageous for more of the larger societies to hold regional meetings for the presentation of short reports on current research, and to reserve for the annual meetings the presentation of mature work and extensive symposia. As a matter of fact, a number of societies, such as the American Mathematical Society, have long held what are in effect regional meetings. But in this complex world in which the sciences are more and more interrelated, it would be in the long run a serious error for specialists in any field to isolate themselves from specialists in other fields. Cross-fertilization in science is as important as in biology and inbreeding is as likely to lead to sterility.

Another question that will be considered in this transition period is the date of the annual meeting of the association and its affiliated and associated societies. The Christmas holiday period has advantages which are well known, and also serious disadvantages. A meeting of several days at that season of the year is almost certain to conflict with family parties and reunions. Another serious matter is that Christmas varies from year to year throughout the entire week. Furthermore, the Christmas season is always a period of heavy railroad travel and the weather is often unfavorable. Perhaps in the future the latter part of November or early December would be more satisfactory. Of course, there is always the problem for university men of interrupting their lectures. But this disadvantage might be largely relieved by starting the meetings on Thursday or Friday and continuing until the following Tuesday or Wednesday. The British Association for the Advancement of Science usually times its meetings in this way, and with conspicuous success. Since few university lectures are scheduled for Saturdays and not all are given on Mondays, a meeting continuing over the week-end would not seriously disrupt university schedules. There would be advantages, too, for scientists in government bureaus and industrial laboratories.

However, attention must now be centered on the Cleveland meeting in September. Some inconveniences must be expected but, with our entire economic order disrupted by the war, scientists will be as inventive in overcoming difficulties as are farmers and manufacturers. The problem of "reconversion" for most scientists will be relatively simple.

The New York conference listed a number of subjects suitable for programs at the Cleveland meeting, such as "science and the post-war world, with particular emphasis upon rehabilitation, education and research; science and world peace; a national policy for science; agencies which support science; science and government; science and civilization; science and research; science and education; science and rehabilitation; can science exist half free and half controlled?"

Evidently not all these important problems can be discussed at one meeting, but such questions should be considered at meetings of the association because scientists are members of society and strongly influence our social order. Such subjects should be examined because reflection on them will broaden the vision of scientists and aid them to guide the development of science more wisely. They should be considered in open forums in order to place before the general public the high purposes of science, something of its methods, and its supreme importance for the advancement of civilization. This last reason for such discussions is not the least, for ultimately the progress of science will rest upon society as a whole.

THE EFFECTIVENESS OF OVARIAN AND HYPOPHYSIAL GRAFTS IN THE PRODUCTION OF MAMMARY CARCINOMA IN MICE[1]

By Dr. LEO LOEB, Dr. H. T. BLUMENTHAL and MARIAN MOSKOP KIRTZ
LABORATORY OF RESEARCH PATHOLOGY, WASHINGTON UNIVERSITY SCHOOL OF MEDICINE, ST. LOUIS, MO.

Two methods are available for the determination of the effects of internal secretions: (1) A diminution or elimination of the function of the organ in which certain hormones are produced should lead to a quantitatively corresponding diminution in the structural or functional effects of these hormones. (2) An increase in the quantity of the hormones should be followed by an increase in their effects. By a quantitatively graded diminution of the time during which the ovaries gave off hormones which stimulate the activities of the mammary gland, it was first shown that there exists a quantitative relation between the origin of mammary carcinoma in mice and the cancerigenic action of ovarian hormones on the mammary gland in mice.[2] This represented also the first demonstration that hormones may cause the development of cancer and that substances normally produced in the body in the usual quantity may be responsible for the initiation of cancer; it was pointed out that presumably also other hormones may have cancerigenic effects in the organs and tissues on which they act specifically and that it appears probable that with the cooperation of hereditary conditions all those internal secretions, which initiate or sustain continuous or periodic growth processes, are factors in the origin of cancer.[3] The hormones interact with genetic-hereditary (constitutional) factors in a quantitative manner approximately in accordance with the equation S (hormonal stimulation) × H (hereditary-genetic factors) = C (Cancer).[2] This equation applies also to other types of cancer, and a similar equation applies even to other biological phenomena. More recently it has been shown by Bittner[4] that in addition to these two factors a substance present in the milk, as well as in certain organs of the mother and transmitted to the sucking child, may play a part in the origin of mammary carcinoma, although not of cancer in general. It seems probable that this factor acts in a way similar to that in which genetic factors act, namely, by determining the degree of responsiveness (sensitization) of the tissues to the stimulation by ovarian hormones.

After the proof had thus been given by means of the first method that endogenous hormones may cause the development of cancer, the attempt was made to supplement this proof by increasing the incidence of mammary cancer and accelerating the time of its appearance by increasing the quantity of ovarian hormones in accordance with the second method. This was first attempted by the transplantation of ovaries from sisters to castrated brothers in as yet incompletely inbred strains of mice. These first attempts failed, probably because an insufficient similarity between the individuality differentials of host and donor of the transplants prevented a satisfactory functioning of the grafts.[5] In subsequent similar experiments in a more closely inbred strain Murray was able to observe the formation of mammary tumors in about 7 per cent. of castrated male mice;[6] and more recently de Jongh and Korteweg[7] obtained positive results in a higher percentage of animals. Development of mammary tumors in male mice was induced also by Lacassagne by means of injections of very large doses of estrogen over long periods of time.[8] Several years ago it could be shown moreover that implantation of anterior lobes of the hypophysis into virgin females of strain A, which had been closely inbred by L. C. Strong, raised the incidence of mammary carcinoma in these mice to approximately 42 per cent. from about 4 per cent. in controls, while in low mammary tumor rate strains merely increased proliferative and secretory processes in the mammary gland could be obtained. However, positive effects of the anterior pituitary grafts were noted only if ovaries were present in the hosts; in ovariectomized females and in males the results were negative.[9]

We now wish to report on new experiments on 427 mice, which had received transplants of ovaries or anterior pituitaries or a combination of both, as well as on the findings in 504 control mice which had not

[1] This investigation was carried out with the aid of a grant from the International Cancer Research Foundation.

[2] A. E. C. Lathrop and Leo Loeb, *Jour. Cancer Res.*, 1: 1, 1916; L. Loeb, *Jour. Med. Res.*, 40: 477, 1919; SCIENCE, 43: 293, 1916; *Am. Jour. Med. Sciences*, 19: 781, 1920; *Jour. Cancer Res.*, 2: 135, 1917; 8: 274, 1924; *Report Internat. Conference on Cancer, London*, p. 84, 1928; C. F. Cori, *Jour. Exp. Med.*, 45: 983, 1927; L. Loeb, *Acta Union Internat. Contre Cancer*, 2: 148, 1937; *Jour. Nat. Cancer Inst.*, 1: 169, 1940.

[3] L. Loeb, SCIENCE, 42: 912, 1915.

[4] J. J. Bittner, SCIENCE, 84: 162, 1936; *Am. Jour. Cancer*, 30: 530, 1937.

[5] L. Loeb, *Jour. Med. Res.*, 40: 477, 1919.

[6] William Murray, *Jour. Cancer Res.*, 12: 8, 1928.

[7] L. E. de Jongh u. R. Korteweg, *Act. Brev. Neerland.*, 5: 126, 1935.

[8] A. Lacassagne, *C. R. Acad. d. Sci.*, 195: 630, 1932.

[9] L. Loeb and Marian Moskop Kirtz, *Am. Jour. Cancer*, 36: 56, 1939.

received transplants of ovaries or lobes of the hypophysis. The organs and grafts were examined microscopically partly by means of serial sections. Usually from two to four anterior pituitaries or ovaries or a combination of both these organs were transplanted into each of the 427 mice. Somewhat more than one half of these experiments were carried out in strain A mice which are most suitable for investigations in transplantation; the remaining mice belonged to the high tumor rate strains C3H and D, to the medium tumor rate strain New Buffalo and to the low tumor rate strains C57, CBA, Old Buffalo and AKA. Some of the earlier experiments are included in this report. It may be stated that in male mice mammary gland carcinoma hardly ever occurs spontaneously in any strain, nor was mammary gland carcinoma observed in the strain A virgin females which served as controls.

Our principal observations and conclusions are as follows: (1) After transplantation of ovaries into castrated male mice the cancer rate and proliferative as well as secretory activities of the mammary gland were greater than after transplantation of these organs into normal female mice. Transplantation of ovaries into normal female mice led to the development of tumors only in strains C3H and D in which the mammary gland is most strongly sensitized to stimulation by hormones; negative results were obtained with our strain A mice which are less strongly sensitized. (2) Transplantation of anterior pituitaries, obtained in the majority of experiments from brothers or sisters, into normal female mice is at least as effective as transplantations of ovaries into castrated male mice; it is much more effective than transplantation of ovaries into normal female mice. (3) Transplantation of a combination of ovaries and anterior pituitaries into normal female mice is as effective as transplantation of anterior pituitaries alone into the same kind of hosts, or it may perhaps be somewhat more effective. These combined transplants were very active in castrated male mice in strain A in which they produced a cancer rate of 92 per cent. (4) In low tumor rate strains these various kinds of grafts, which in high tumor rate strains caused the development of cancer, induced merely an increase in proliferative processes, often associated with secretory activities in the mammary gland. (5) The greatest intensity of cancer development, and as a rule also of preparatory activities of the mammary gland, was obtained only in mice which belonged to the highest weight classes in conformity with our earlier observations.[10] There existed a certain parallelism between the weight of the mice and the effectiveness of these hormones. (6) By means of a single transplantation of glands, which produce mammary gland-stimulating hormones, as marked a development of mammary cancer in castrated male mice may be initiated, without otherwise pathological effects being noticeable, as by injections of very large amounts of estrogen continued over long periods of time. A mammary cancer rate in castrated male mice may thus be obtained which far exceeds the cancer rate of normal virgin female mice. (7) After transplantation of anterior pituitaries into ovariectomized mice, growth response and tumor formation in the mammary gland were either diminished or entirely prevented. Likewise transplantation of ovaries alone or together with pituitaries into normal male mice did not stimulate the growth of the mammary gland nor cause formation of mammary carcinoma. The anterior hypophysis transplants seem to exert their effects on the mammary gland by way of the ovaries which, under the influence of this additional stimulus, in all probability produce larger amounts of estrogenic hormones than they would otherwise do. Ovariectomy has therefore an effect which greatly differs from that of castration in male mice, which latter enhances the cancerigenic action of ovarian transplants. (8) The development of cancer was observed in these experiments as a rule only after the transplants had been active in the host for a period of about from 6 to 7 months to 12 months, so that the age of the mice at the time of examination ranged approximately between 9 and 14 months. If the examination of the organs took place earlier, the proliferative activities in the mammary gland, often coupled with secretory processes, had not as yet progressed to cancer formation; the latter represents the last stage reached after the tissue has passed through the preliminary or preparatory growth processes in which sensitization of growth stimuli may take place. It has been suggested that at the end of this period an autocatalytically propagating growth substance has developed in the cells as the result of the preceding long-continued stimulation, a substance which would thus be directly responsible for the ensuing cancerous growth.[11] The facts established in the present investigation are in harmony with this interpretation. Within the last twenty-five years a number of investigators have carried out experiments concerning the action of ovarian and pituitary hormones on growth and secretion in the mammary gland.[12] While in some respects the results

[10] L. Loeb, V. Suntzeff, H. T. Blumenthal and M. Moskop Kirtz, *Arch. Path.*, 33: 845, 1942.

[11] L. Loeb, SCIENCE, 43: 293, 1916.

[12] C. R. Moore, SCIENCE, 52: 179, 1920; *Jour. Exp. Zool.*, 33: 129, 1921; C. R. Moore and D. Price, *Am. Jour. Anat.*, 50: 13, 1932; A. Lipschütz and collaborators, *Pflüger's Arch.*, 211: 206, 305 and 697, 1926; E. T. Engle, *Proc. Soc. Exp. Biol. and Med.*, 25: 83, 1927–28; 25: 715, 1927–28; G. K. Smelser, *Physiol. Zoology*, 6: 396, 1933; W. U. Gardner, *Endocrinology*, 19: 656, 1935; C. E. Lane, *Am. Jour. Physiol.*, 110: 681, 1935; A. A. Lewis and C.

obtained in these various investigations appear contradictory to one another, on the whole the conclusions of the majority of these investigations agree with our observations concerning the processes taking place during the preliminary growth period. (9) There are two principal conditions which inhibit or prevent the development of mammary cancer by ovarian or anterior pituitary transplants: (a) The genetic constitution of the animals or a deficiency in the amount of available milk factor may cause an insufficient degree of sensitization and responsiveness of the mammary gland tissue to the specific hormones (Strains C57, CBA and Old Buffalo). (b) Lack of a sufficient similarity between the individuality differentials in host and donor of the transplants may prevent the survival and function of the grafts for sufficiently long periods of time (strains AKA and also New Buffalo). As pointed out previously, even long-continued close inbreeding of strains of animals does not seem to lead to a completely homozygous condition, owing probably to mutations which occur in these inbred individuals[13] and this applies also to all the closely inbred strains of mice so far tested by us. (10) It has been shown that not only ovarian hormones but also pituitary hormones may be involved in the development of mammary carcinoma in mice and presumably also in other species, in accordance with the conclusion that all those hormones or other factors which stimulate growth processes in an organ or tissue may thereby also affect the production of cancer.

THE CONTRIBUTION OF JAMES McKEEN CATTELL TO AMERICAN ANTHROPOLOGY

By Dr. CLARK WISSLER
THE AMERICAN MUSEUM OF NATURAL HISTORY

PROFESSOR JAMES MCKEEN CATTELL died on January 20, 1944. He was widely known as a psychologist and editor of scientific journals, but his contribution to the development of anthropology in the United States seems to have been forgotten. That he played an important role in the history of anthropological teaching may be suspected when we note that for the academic years 1896–1902 he was head of a department of anthropology and psychology at Columbia University. To most anthropologists of the present generation, this may appear as a surprising statement, so, as an outline of the history of anthropology at Columbia University, we submit the following chronological data:

1891. J. McKeen Cattell appointed professor of psychology at Columbia; previous position in University of Pennsylvania.
1893. Livingston Farrand appointed instructor in psychology at Columbia; began giving a course in anthropology also.
1896. Cattell listed as head of the department of anthropology and psychology; Farrand still giving anthropology courses and Franz Boas listed as lecturer.
1901. Farrand listed as professor of psychology, but continues to give courses in anthropology.
1902. Anthropology listed as a separate department, Boas as head, Farrand as a professor of anthropology. Cattell now head of department of psychology.

The interest of Cattell is clearly indicated; he wished to provide for the teaching of anthropology, encouraged Farrand to give courses, later brought Boas into the picture and at the opportune time saw to it that a separate department of anthropology was created. Boas came to New York in 1895 as assistant curator at the American Museum of Natural History under F. W. Putnam; Cattell added Boas to his staff in 1896. Cattell seems to have been acquainted with Boas at Clark University through the work of the latter on the growth of children. Cattell studied with Galton and Pearson in England, where he acquired a deep and lasting interest in anthropometry, so it is to be expected that Boas would come to his notice when he began to write on anthropometry in 1891. It is plain, however, that Cattell was committed to the promotion of anthropology before Boas came into the New York picture.

At Columbia the writer was assistant in psychology, 1899–1900; university fellow in psychology, 1900–1901; assistant and eventually lecturer in anthropology, 1903–1909. These facts are cited to indicate his personal contact with the situation beginning with 1899.

The writer first saw Cattell at a meeting of the American Association for the Advancement of Science in the summer of 1899 at Columbus, Ohio. He participated in the program of Section H, with other psychologists, demonstrating a few testing instruments. incidentally he made a direct appeal to anthropologists to make measurements on Indians and Negroes to secure comparative data. F. W. Putnam was present, speaking enthusiastically in support of the idea. It was clear that a mutual feeling existed in the minds

W. Turner, *Mo. Agr. Exp. Sta. Research Bull.*, No. 310, 1939; A. A. Lewis, C. W. Turner and E. T. Gomez, *Endocrinology*, 24: 157, 1939; J. P. Mixner and C. W. Turner, *Endocrinology*, 30: 591, 1942.

[13] L. Loeb, H. D. King and H. T. Blumenthal, *Biol. Bull.*, 84: 1, 1943.

of these two aggressive leaders that laboratory psychology and anthropology formed a logical team.

Joseph Jastrow, professor of psychology at the University of Wisconsin, was the first laboratory psychologist to become active in Section H, joining the association and presenting his first formal paper in 1886. He was elected chairman of Section H in 1891, the first psychological chairman. Cattell was the second, elected in 1897 and during the same year presented a paper outlining a plan for the "Study of Eminent Men." Cattell's address as retiring chairman of Section H was strongly in praise of anthropology and its objective character and also insistent upon its integration with psychology. Following Jastrow, psychological papers were presented in Section H with fair regularity. In 1907 the name of Section H was changed to Anthropology and Psychology and alternating chairmen became the rule: in 1919, psychology was given a section of its own.

The interest of laboratory psychologists in anthropology was stimulated by Wundt in Germany, the founder of laboratory psychology, who extended his researches into anthropology; so it is natural that his American students (Hall, Jastrow, Cattell and others) should become enthusiastic promoters of academic anthropology in the United States. Cattell studied with Galton in England, also, and was thus further conditioned to the anthropological bias. William L. Bryan, another student of Wundt, was the writer's teacher in laboratory psychology; he encouraged a course in anthropology at Indiana University by George E. Fellows, a student of Ranke, who regarded anthropology a part of history. (The writer attended this course in 1895.)

Thus it is fair to state that the teaching of anthropology in the United States was, in part at least, promoted by laboratory psychologists of the Wundt and Galton Schools. That Cattell played a conspicuous part in initiating the outstanding national academic department is clear from the foregoing historical data.

In 1896 Daniel G. Brinton of Philadelphia presented a motion in Section H for a "Committee on the Study of the White Race in America." Brinton was the first committee chairman; Cattell, an original member, succeeded Brinton in 1899. In the meantime Cattell received a grant-in-aid from the American Association for the Advancement of Science to devise and construct instruments for making mental and physical measurements as equipment for such a survey. Further, in 1895, Cattell began a series of mental and physical tests on students in Columbia and Barnard Colleges, which ultimately furnished data for the writer's Ph. D. dissertation in 1901.

OBITUARY

FRANK EUGENE LUTZ

IN the passing on November 27, 1943, of Frank E. Lutz, chairman and curator of the Department of Insects and Spiders in the American Museum of Natural History in New York City, entomology has lost one of its most important leaders and one who has influenced a host of younger men through his example, his writings and his educational activities. His versatile biological interests are apparent in his published papers. His ideals of education are to be seen in his museum exhibits, his pioneer work on nature trails, and his writings on popular aspects of insect life, including his famous "Field Book of Insects" (1917) and his more recent "A Lot of Insects" (1941). For many years he edited the *Memoirs* and *Bulletin* of the American Museum and these publications still reflect many of his policies.

Frank Lutz was born in Bloomsburg, Pennsylvania, on September 15, 1879. He graduated from Haverford in 1900 and took his master's degree in 1902 and his doctor's degree in 1907 from the University of Chicago under the direction of Dr. C. B. Davenport. His doctoral thesis was entitled "The Variation and Correlations of Certain Taxonomic Characters of *Gryllus*," and Dr. Lutz continued his interests in crickets as well as other aspects of insect biology until his death. As late as 1938 he published sound recordings of cricket calls. His early interest in variation, which included work in Karl Pearson's laboratory in London (1902), led directly to studies in genetics, and he was one of the early students of *Drosophila* genetics. He records in his latest book how he became interested in *Drosophila* while working as research investigator at the Carnegie Institution at Cold Spring Harbor and how he noted a white-eyed form and gave the strain in which it appeared to Dr. T. H. Morgan, who initiated the experiments that have made *Drosophila* a standard laboratory animal and genetics a great biological science. Dr. Lutz was brought to the American Museum for the preparation of exhibits on variation and heredity, was appointed assistant curator in 1909, becoming associate curator in 1917 and curator in 1921. Although he took part in twenty-four expeditions to Central and South America, the West Indies and various parts of the United States, during which he collected great numbers of insects that were subsequently studied by various taxonomic specialists, he rather prided himself upon the fact that he never described a new species. He became especially interested in bees and made numerous

studies on their reaction to ultra-violet patterns, but the recording of new forms he preferred to hand on to others. Under his curatorship, the insect and spider collections of the American Museum became one of the most important in the world, numbering almost two million specimens.

Probably his best known "expedition" was to his own back yard and its immediate surroundings near his suburban home in Ramsey, New Jersey. The record of this "expedition" is contained in "A Lot of Insects" written with his characteristic humor and his ability to open up problems of insect life to the lay student as well as to the professional entomologist.

Dr. Lutz's contributions to ecology are numerous and varied. In addition to the reports on his ingenious and novel experiments on insect sounds and visual reactions, he published papers on insect adaptations, spider webs, non-selective characters, diurnal rhythm, insects of thermal waters, humidity in relation to insect physiology, galls, and caddis-worm case building. In his early years he became skeptical of such remarkable cases of recorded adaptation as mimicry of butterflies and defensive capacity of soldier termites, and this skepticism is again apparent in his most recent book.

In addition to improvising and directing the exhibits of insects at the American Museum, Dr. Lutz became interested in 1925 in the exhibition of living animals and plants by means of labelled nature trails and the success of this form of nature education has spread widely. His work in these fields of interest again exhibits his characteristic originality and ingenuity. He always did his best to give information concerning insects to innumerable visitors to the American Museum, and his "Field Book of Insects" was in reality an attempt to answer the common questions about insects asked by the general public.

Numerous scientific honors were bestowed upon Dr. Lutz during the course of his life. He was a member of the American Society of Zoologists and the American Society of Naturalists, he was starred in the second edition of American Men of Science, he was a fellow of the Entomological Society of America and the New York Academy of Sciences, he received the A. Cressy Morrison Prize of the New York Academy of Sciences in 1923, and he was president of the Entomological Society of America in 1927.

In 1904 he was married to Martha Brobson, who survives him together with four children, Frank B. Lutz, Anna Lutz, Ensign Laura Lutz, of the WAVES, and Mrs. Boyd Schurman. It was a pleasure to be entertained in the Lutz home in the nineteen-twenties when the four children were growing up. Both Dr. and Mrs. Lutz joined in the children's games, and any visitor likewise found himself involved. Dr. Lutz, naturally of a nervous disposition, was endlessly patient with the most trivial questions from the children. A genuinely important bit of insect research would be laid aside while a fourth-grade arithmetic problem was so clarified that I am sure many a public school teacher in Ramsey must have received, at third hand, some echo from the Pearson Laboratory.

The bare outline of some of the achievements of his life fails to convey the essence of Dr. Lutz's colorful personality and geniality. His enjoyment of life may be detected in his books which reflect his interest in the unusual as well as the usual. His rich sense of humor was always present in his personal relations as well as in his writings, whether for a professional or lay reader. Possibly his character was best exhibited in his relations to his non-professional colleagues. He was always interested in the amateur naturalist and enjoyed the company of those who made biological studies a hobby rather than a duty. Those who associated with him for years in the New York Entomological Society meetings will understand these qualities of congenial friendliness which are hard to set forth in words.

His own anecdotes were delightful and I am sure he would not mind having one told about him. I attended a meeting of the New York Entomological Society, I believe in 1920, when a speaker was engaged in giving a rather lengthy description of taxonomic characters of a certain group of insects. Dr. Lutz was sitting in the rear of the room and soon was heard to say "Oh Lord!" quite audibly. The speaker said, "In view of the sounds of protest from Dr. Lutz, I shall try to hurry through these descriptions," whereupon Dr. Lutz rejoined, "Go right ahead! At the next meeting I intend to read a check-list of the bees of North America."

ALFRED E. EMERSON

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RECENT DEATHS

DR. LEROY S. PALMER, professor of agricultural biochemistry and chief of the division of the department of agriculture of the University of Minnesota, died on March 8 at the age of fifty-six years.

DR. FRANCIS J. BROGAN, instructor in chemistry at Hunter College, New York City, died on March 13 at the age of forty-four years.

DR. GEORGE HUME SMITH, of Indianapolis, Ind., recently professor of mathematics at Butler University, in the past connected with the departments of botany of the University of Illinois and the University of Missouri, and with *Biological Abstracts*, died on February 7 at the age of forty-seven years.

DR. HENRY ANDREW BUEHLER, geologist and di-

rector of the Missouri State Bureau of Geology and Mines at Rolla, died on March 14 in his sixty-eighth year.

SIR DAVID PRAIN, from 1905 to 1922 director of the Royal Botanical Gardens at Kew, died on March 17 at the age of eighty-six years.

SCIENTIFIC EVENTS

THE ALABAMA RESEARCH INSTITUTE

THE Alabama Research Institute was organized as the result of a year's study by a committee of Alabama citizens appointed in 1940 by the Alabama State Chamber of Commerce. Benjamin Russell, the chairman, submitted the report of the committee to the Chamber of Commerce on October 9, 1941. This report concluded:

> That Alabama could no longer afford to sit idly by and permit its vast variety of materials to remain in their present unutilized and unprofitable condition; but instead that Alabama should through scientific research do that which is necessary to bring these materials into profitable use for the comfort and enrichment of the people of our state, as so many other states in our Union are now doing.
>
> Your committee therefore, after unanimously reaching the conclusion that here in Alabama we should have an organization primarily engaged in research work, has drafted a constitution and by-laws for such an agency and adopted as its name Alabama Research Institute.
>
> Alabama Research Institute, in addition to its regular function as a research organization, will act as a coordinating agency in research undertakings, with the University of Alabama, Alabama Polytechnic Institute and other state institutions, and private and corporate organizations in Alabama, covering a broad field as is provided in its constitution. . . .
>
> For the general advancement of our state the Alabama Research Institute needs, and your committee believes will have, the active support of the people of Alabama.

Shortly afterwards the institute was organized as a non-profit corporation.

As now planned, the organization will function in a manner not unlike that of other successful research institutions of similar character, several of which were originally organized and endowed by a few individuals who felt that the field of research should be extended or enlarged. The present approach is on that principle—except that many individuals and business concerns are invited to supply the capital. It is intended that there shall be available within the state a well-equipped laboratory, a comprehensive technical library and scientific personnel for general research purposes.

Initially the institute will be financed almost wholly from subscriptions from business and from individuals. These subscriptions are to be used solely for the purpose of implementing the institute as a going business concern, for the introduction of certain researches on Alabama raw materials, to employ a competent research director and staff, to buy equipment, apparatus and supplies, to obtain and accumulate a technical library, to pay rent for a place for housing the institute and for general overhead and administrative expense. After it has been in operation for a few years, it is hoped that it will be self-sustaining from fees paid by private industry for special research programs and from royalties and profits from patents and discoveries developed by the institute from research in its own behalf.

THE ROCKEFELLER FOUNDATION

A REVIEW of the work of the Rockefeller Foundation for 1943 is given in the annual report of Dr. Raymond B. Fosdick, president of the foundation, which has just been issued. During 1943 the appropriations amounted to $7,760,186. The income from investments during the year was $8,079,164. The appropriations were distributed for the most part in six major fields, roughly as follows:

Public health	$2,450,000
Medical sciences	1,529,000
Natural sciences	599,000
Social sciences	1,068,000
Humanities	1,055,000
Program in China	108,000

Of the money appropriated during the year, 69 per cent. was for work in the United States and 31 per cent. for work in other countries.

In discussing a report from its representatives in Rio de Janeiro that gambiae mosquitoes, some of them alive, had been found in planes coming from Accra and Dakar in Africa to Natal and that five live gambiae had been discovered in dwellings near the Natal airport, the report points out that though the situation is now in hand, it poses a problem of larger significance which can not be evaded.

> Around the ports of Africa and deep within the hinterland lie the breeding centers of the gambiae. The safety of the Western Hemisphere, which is now within a few hours' flight across a narrow ocean, can no longer be left to the uncertainties of a flit-gun campaign. Modern airplane travel has made old methods and ideas of quarantine completely obsolete. If the Americas are adequately to be protected, the breeding places of gambiae, wherever in Africa or elsewhere they may be found, must be eradicated. The campaign must be carried to the sources of infestation. It can no longer be defensive; it must be offensive.
>
> But the problem, of course, is far broader than gambiae.

This newly made world which the airplane has tied together has lost its frontiers. Certainly in the field of public health they no longer have significance or meaning. No line can be established anywhere in the world which confines the interest of any one country, because no line can prevent the remote from becoming the immediate danger. Whether it is malaria or yellow fever or typhus or bubonic plague or whatever the disease may be, the nations of the world face these enemies of mankind not as isolated groups behind boundary lines but as members of the human race living suddenly in a frightening propinquity.

Public health can no longer be thought of exclusively in national terms. Whether we like it or not, our technologies now confront us with inescapable demands for a new approach. Some kind of regularized international cooperation is essential. Whatever we may think of the League of Nations, its Health Organization blazed a new trail in the international attack on disease—a trail that must be widened into a firm road. Certainly a service of epidemiological intelligence covering the whole world is an immediate necessity, and many other essential public health activities not only lend themselves to collective approach but can be effectively handled only by that method.

WAR CONFERENCE ON INDUSTRIAL MEDICINE, HYGIENE AND NURSING

THE second War Conference of industrial physicians, hygienists and nurses will be held at the Hotel Jefferson, St. Louis, Mo., from May 8 to 14. The participating organizations are the American Association of Industrial Physicians and Surgeons, the American Industrial Hygiene Association, the National Conference of Governmental Industrial Hygienists and the American Association of Industrial Nurses.

Subjects to be presented include welding, in relation to clinical aspects and control of hazards; noise, as to medical phases and means of prevention; better health in small plants; the industrial physician's opportunity to advance medical knowledge; maladjustment and job environment; women in industry, and panel discussions on "Who Can Work?," etc. Two clinics, one surgical, at Barnes Hospital, and the other medical, at Desloge Hospital, will be held during the meeting.

The hazards to health presented by the new synthetic rubber industry, radium, solvents and the toxicology of TNT will be considered; also the possibilities of an excessive silica dust hazard from the quartz crystal industry, which has recently sprung up in many areas of the country; techniques of air sampling in specific reference to the reducing of oil mists and lead fumes, the latter encountered in soldering operations where the hazard is increasing with lack of adequate supplies of tin; and the danger of exposure to cadmium, which is known to be more poisonous than lead and which is responsible for a number of cases of poisoning.

The industrial nurses will consider postwar planning for nurses and medical services in industry.

Reservations at the Hotel Jefferson can be obtained by writing promptly to John Reinhardt, chairman of the "War Conference" Housing Bureau, Syndicate Trust Building, St. Louis, Mo.

THE CLEVELAND MEETING OF THE AGRICULTURAL AND FOOD DIVISION OF THE AMERICAN CHEMICAL SOCIETY

RESEARCH in the problems of food during the war will be reported to the Agricultural and Food Division of the American Chemical Society at the one hundred and seventh meeting of the society to be held in Cleveland from April 3 to 7.

Papers dealing with practically every aspect of food chemistry will be contributed by members of the laboratories of universities, industries and federal services. On Thursday, April 6, there will be a symposium on the biological value of proteins with Roger B. Lueck, of the Research Department of the American Can Company, presiding. The opening address at the morning session will be delivered by Dr. H. H. Mitchell, professor of animal nutrition at the University of Illinois, whose subject will be the significance of the biological value of proteins. Dr. Max S. Dunn, professor of biochemistry at the University of Southern California, will speak on optimal growth, a criterion of the biological value of proteins and amino acids. Dr. D. Breese Jones, head of the protein division of the U. S. Department of Agriculture, will discuss the nutritional and supplementary value of some plant proteins. Other speakers at the morning session will be Dr. Anthony Albanese, of the department of pediatrics of the Johns Hopkins University, who will discuss amino acid analysis of some common vegetables, and Dr. William H. Adolph, a former professor of biochemistry at Yenching University, Peking, who will speak on the protein problem in China.

The afternoon session will be devoted chiefly to a series of papers on amino acids as follows: Dr. Richard Block, of the New York State Psychiatric Institute, on "a comparative study of essential amino acids in food proteins and some implications for nutrition"; "on the human requirements for amino acids" by Drs. John R. Murlin, Estelle Hawley and R. R. Sealock, of the School of Medicine of the University of Rochester, this paper to be read by Dr. Sealock; Dr. Sidney Madden, also of the School of Medicine, on "amino acids and plasma protein regeneration," and Dr. L. Emmett Holt, Jr., of the Johns Hopkins University, on "the pathological effects of specific amino acid deficiencies."

Dr. Frank G. Boudreau, executive director of the Milbank Fund of New York City, will give the concluding address on the impact of the war on the world food situation.

The program for Tuesday, April 4, will include a symposium on vitamin research given jointly with the Division of Biological Chemistry, and a symposium on carbohydrates for industrial use arranged in cooperation with Drs. Hilbert and Rice, of the Sugar Division. Papers for these sessions have not been announced.

A general session will be held on Wednesday morning, April 5, with Paul Logue, of the Monsanto Chemical Company, St. Louis, secretary of the division, presiding. Papers will be presented dealing with the application of chemical technology to agricultural and food problems.

SCIENTIFIC NOTES AND NEWS

THE gold medal of the Royal Astronomical Society, London, has been awarded in recognition of work on the observation and interpretation of spectra of stars and nebulae to Dr. Otto Struve, director of the Yerkes Observatory, Williams Bay, Wis., and of the McDonald Observatory of the Universities of Chicago and Texas.

THE Warren Triennial Prize of $500 of the Massachusetts General Hospital has been awarded to Dr. David G. Cogan, Dr. V. Everett Kinsey and Erwin O. Hirsch, of the Howe Laboratory of Ophthalmology of the Harvard Medical School, for an essay entitled "Physiological Studies on the Cornea."

DR. WALTER B. CANNON, George Higginson professor emeritus of the Harvard Medical School, visiting professor at New York University, was the guest of honor at a dinner given on March 8 at the Hotel Commodore, New York City, by the American Soviet Medical Society in recognition of his work on shock. The main address was made by Dr. Vladimir V. Lebedenko, Red Cross representative for the United States of the U.S.S.R.

DR. FREDERIC A. WOLL, professor of hygiene at the College of the City of New York, president of the State Board of Optometry, was the guest of honor at a reception given at the Hotel Pennsylvania on March 8 by the Optometrical Society of the City of New York. Professor Woll, who will retire from active service this year, was presented with a telescope. Dr. George B. Pegram, of Columbia University, made an address in appreciation of his work.

DR. THOMAS T. READ, Vinton professor of mining engineering at Columbia University, has been elected president of the University Kappa Chapter of the Society of Sigma Xi. Dr. S. R. Detwiler, professor of anatomy, has been made vice-president and Dr. John S. Karling, associate professor of botany, secretary-treasurer.

DR. WILBUR A. SAWYER, New York, was inducted into the presidency of the American Society of Tropical Medicine at the recent annual meeting. Dr. Rolla E. Dyer, Bethesda, Md., was chosen *president-elect;* Dr. Harold W. Brown, New York, *vice-president,* and Dr. Joseph S. D'Antoni, New Orleans, *secretary-treasurer.*

DR. WILLIAM CULLEN, consulting chemical and metallurgical engineer, has been elected president of the British Science Masters' Association in succession to Dr. Frederick Soddy, F.R.S., who until his retirement in 1936 was professor of chemistry at the University of Oxford.

SURGEON REAR-ADMIRAL G. GORDON-TAYLOR has been appointed Thomas Vicary lecturer of the Royal College of Surgeons, London, for the year 1944.

DR. ALEXANDER PETRUNKEVITCH, who joined the staff of the Osborn Zoological Laboratory of Yale University in 1910, becoming in 1917 professor of zoology, has retired.

SAMUEL NEWTON SPRING, since 1933 dean of the State College of Forestry at Syracuse University, will retire on July 1.

DR. HAMILTON H. ANDERSON, professor and head of the department of pharmacology of the Peiping Union Medical College, Peking, who recently returned to the United States, has been appointed professor of pharmacology at the Medical School in San Francisco of the University of California. He succeeds Dr. Chauncey D. Leake, who resigned to become vice-president and dean of the Medical Branch, Galveston, of the University of Texas.

DR. JAMES A. SHANNON, associate professor of medicine in the New York University College of Medicine, has been promoted to a professorship of pharmacology and has been made chairman of the department.

DR. WILLIAM H. NEWTON, head of the department of physiology at University College, London, has been appointed George Holt professor of physiology in the University of Liverpool. He succeeds Dr. Herbert Eldon Roaf, who is retiring.

DR. WALTER J. CRAIG, director of the division of orthopedics of the New York State Department of

Health, Albany, has retired. He will devote his entire time to the private practice of orthopedic surgery.

DR. OSKAR BAUDISCH, director of research at the Saratoga Spa, has been appointed a temporary collaborator in conjunction with members of the laboratory staff of the Plant Soil and Nutrition Laboratory at Ithaca of the U. S. Department of Agriculture, for work on boron and other "trace minerals."

DR. ROY M. SEIDEMAN, formerly of Rochester, N. Y., has been appointed industrial hygiene physician in the Bureau of the Connecticut State Department of Health at Hartford.

DR. JULIAN A. STEYERMARK, assistant curator of the herbarium of the Chicago Natural History Museum, on leave for government war work, has been transferred recently from Ecuador, where he was engaged in quinine investigations, and is now carrying on the same work in Venezuela.

IT is stated in the annual report for 1943 of the Rockefeller Foundation that Dr. Bernardo Houssay, of the University of Buenos Aires, who was one of the hundred and fifty distinguished citizens of Argentina dismissed from their posts for signing the petition "for effective democracy and American solidarity," is continuing research in a small laboratory established for him by an Argentine foundation. The Rockefeller Foundation has made a grant for equipment and supplies and for stipends to several young investigators who wish to work with him.

DR. ANTON J. CARLSON, professor of physiology emeritus of the University of Chicago, president of the American Association for the Advancement of Science, will be a guest speaker at the ninety-third annual session of the Iowa State Medical Society which will be held at Des Moines on April 20 and 21. His address will be entitled "The Physiological Aspects of Cardiac Disease."

DR. HERBERT GROVE DORSEY, of the U. S. Coast and Geodetic Survey, will lecture on March 25 before the Philosophical Society of Washington on "Radio Applied to Ocean Current Observations."

THE preliminary program of the fifth annual convention of the Institute of Food Technologists, which will meet on May 29, 30 and 31 at the Edgewater Beach Hotel, Chicago, has been issued. The meeting is being organized to cover three different aspects of food technology. The opening program will review developments since the last annual meeting at St. Louis in June, 1943. The speakers on the second day will discuss problems connected with the war effort, and the third and final session will be devoted to immediate future and post-war problems. Those wishing to attend are urged to make reservations for rooms without delay.

THE thirty-fifth annual meeting of the American Oil Chemists Society will be held at New Orleans from May 10 to 12. In addition to general papers there will be a symposium on the physical properties of fats and oils, which will include papers on x-ray and ultraviolet spectroscopy, specific and latent heats, viscosity and plasticity, and the practical application of physical methods of processing, including liquid-liquid extraction and continuous solidification of lubricating greases.

THE U. S. Senate voted on March 15 to authorize an expenditure of $20,000 to make the first over-all survey in sixty years of the fishing resources of the United States.

ACCORDING to *The Museum News*, the Michigan Planning Commission is presenting to the state legislature early this year a recommendation that one million dollars be appropriated to save the Porcupine Mountains area of the Upper Peninsula. The area has 46,000 acres and a 17-mile shoreline on Lake Superior.

BY the will of James Colby Colgate the sum of $100,000 is bequeathed to Colgate University, of which he was a trustee.

THE botanical library of Charles C. Deam, containing 3,500 bound volumes besides pamphlets, reprints and periodicals, has been given to the Deam Herbarium of Indiana University.

IT is reported in the *Journal* of the American Medical Association that two annual awards have been established under the sponsorship of the American Academy of Allergy. One is the Abbott Award, for both members and non-members of the academy, which consists of an annual prize of $200 established by the Abbott Laboratories of Chicago, to be granted annually for the most important advancement in the field of allergy or for the development of a research problem on any phase of the subject. The second award, to be known as the Secretary's Prize, is a medal to be given annually to a member of the academy for "the most outstanding achievement of the year in the general field of allergy."

ACCORDING to *The Experiment Station Record*, a recent news release from United China Relief announces that a small experimental farm is being conducted in Laurel, Fla., under the auspices of Lingnan University, one of the Christian colleges supported through United China Relief. This farm consists of about five acres, about fourteen miles south of Sarasota, where similarities in climate and growing conditions to those encountered in south China are making possible increased experimentation with Chinese plants which, although already introduced into the United States, have not yet been extensively grown here.

To enable graduates of high schools to advance

themselves a full year in chemistry in connection with the war emergency, the University of Pittsburgh will offer an eight-credit course in general chemistry during the eight weeks from June 26 to August 19. To enable college and university students to advance similarly, an eight-week course in organic chemistry will be offered for eight credits. Also beginning on June 26, twelve-week (full semester) courses will be offered in inorganic, analytical, organic and physical chemistry, and graduate courses in the field of advanced organic (type reactions and microanalysis) and physical chemistry, enzymes, kinetics and plastics. A special course covering "Recent Developments in Theoretical and Applied Chemistry" will be given for instructors in preparatory schools. Only full-time regular staff members will be in charge of these courses.

IT is reported in *The Times*, London, that the plan to train 50,000 pharmacists in China during the next ten years is being helped by the Pharmaceutical Society of Great Britain, which is sponsoring a proposal to offer scholarships of £700, to include traveling expenses, for each of two years at the University of London to Chinese pharmaceutical graduates who undertake to return as teachers.

DISCUSSION

EDITORIAL CHANGES IN SCIENTIFIC PAPERS[1]

PROFESSOR BOYD'S protest[2] against certain editorial practices deals mainly with the question whether such a term as "horse serum" is good English. That matter might have been disposed of more briefly. No one blessed with horse sense would call it "equine sense"; any one who did might arouse a horse-laugh. And if a serum obtained from a horse is "equine," one obtained from a donkey could only be "asinine."

More serious questions are brought up by Professor Boyd's observing that many manuscripts are completely reworked, and incidentally altered in meaning, without consulting the author. That seems hard to justify except on the ground either of great haste or of editorial infallibility. But the plea of haste would rarely be valid; and I have seen many manuscripts that had suffered editorial changes for the worse. As to matter that one sees only in print, it is impossible to determine just how good or bad the editing has been. Unfortunately for those who edit, their mistakes are open to the censure of critical readers, whereas the improvements they make are generally unperceived. It does not seem uncharitable, however, to assume that when a printed article contains obvious errors in syntax and punctuation, or when it is ineffective in ways that could easily be remedied, it has not been so well edited as it might have been; and that, it seems to me, is the case with much current scientific literature. If, as is probable, the faults of style in printed manuscripts were mostly in the original manuscripts and merely left in by the editors, most scientific manuscripts need more editing than they now receive. But more editing would not help unless it were good editing, and I believe that the quality of our editing could be improved (1) by assigning each of the several tasks that editing comprises to a person having special aptitude for that task, and (2) by humanizing the relations between editors and authors.

Editing begins with an administrative task, usually assumed by an editor in chief—that of determining what shall be published. Another task, essentially clerical, is the insuring of compliance with printers' conventions—including hyphens, for example, but not punctuation. A third consists in trying to improve the literary style by making it not only correct but effective.

For this work, which is what most people have in mind when they use the word "editing," I can think of no better name than "literary editing." One shrinks a little from using the word "literary," which may suggest, to some readers, endowing the style of all authors alike with qualities that are "literary" in the sense of "arty." But a good literary editor would surely not try to make either a G. K. Gilbert or a John Doe write like Walter Pater—nor yet like Ernie Pyle. He would always wish the style to be characteristic of its author's better self, and also suitable to its purpose, which would not be that of either Pyle or Pater.

By way of equipment, the literary editor would need more than a little stock of rules learned by rote, eked out with a few taboos, in the dim light of which he might revise each sentence by itself until it was grammatically correct. One who works in such a fashion may forget that a sentence can be correct and yet absurd when considered in relation to its context. Good editing, like all intelligent reading, all effective writing, and all rational thought, is a matter of relations. A good editor, therefore, will not be exclusively concerned with mere correctness; he will try to help the author make relations clear, and to bring out the relative importance of things by proper distribution of emphasis. He needs a literary sense, which I take to mean good judgment, drawn from a store of subconscious memories of his reading, as to what constitutes good usage. He needs also a critical sense,

[1] Published by permission of the director of the Geological Survey, U. S. Department of the Interior.
[2] SCIENCE, 98: 197, August 27, 1943.

in order to see what is wrong when he has trouble in understanding what the author says, or when his interest flags, and in order to find a remedy. The critical temper is commonly regarded, indeed, as unamiable, but a literary editor who was not critical would be no better than a piano-tuner who was tone deaf. Without a critical sense, the literary editor could not do what he has most at heart, which is to help the author make the best of his case.

He must also instinctively desire, one would imagine, to make his purposes understood by the author. That he can do to some extent by writing explanatory notes on the manuscript, and by sending a letter to the author when the manuscript is returned to him for consideration. The most obvious reason for sending back the edited manuscript is to give the author a chance to correct possible alterations of meaning. But the marginal notes and a considerate personal letter will, moreover, dispose him to consider the changes on their merits. When he can do that, he is likely to accept rather extensive changes without protest, and to point out those that he thinks unwarranted with some degree of good humor. When, on the other hand, he finds unexplained alterations in a proof that is accompanied by a request to "correct only typographical errors," his judgment is clouded by a sense of injury; he sees only the changes that he dislikes, and is in no mood to appreciate other changes which, could he consider them calmly, he might gratefully acknowledge to be improvements.

Other good effects are likely to ensue. The author may learn something that will make him write a little better for the rest of his life. Yes, and the editor may learn something to his own equally lasting advantage. A breaking down of icy walls, a climbing down from ivory towers, a letting in of air, would make for better editing as well as better writing.

FRANK C. CALKINS

GEOLOGICAL SURVEY,
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E. H. MCCLELLAND, in his retort[1] to Dr. Boyd's objections to arbitrary editorial changes of nouns to adjectives[2] makes the flat statement that it is a fallacy that parts of speech may be connected without the use of connectives. One would like to know his authority for this statement. Whatever its basis, the rule seems definitely disproved by the facts that (a) languages exist, like Chinese, in which no connectives are ever used, (b) the English language is full of expressions, such as "fence post," "rat poison," "medicine man," etc., which demonstrate very clearly that the use of nouns as adjectives, at least in a great many cases, is consistent with the genius of the language. No connectives are used in such expressions, and none are needed.

Whereas the traditional usage sounds familiar and is understood, the "reformers," who apparently want an adjectival form for every noun used as an adjective, seem to be attempting to foist off on us forms which are unnecessary and repugnant, such as "tetanal toxin," "porcine serum," etc. Furthermore, Mr. McClelland ignores the fact that in many cases the change to an adjectival form actually alters the meaning of the expression. "Porcine," for example, is certainly generally used to mean "looking like a pig," and we do not want to imply that there is anything piggy about the appearence of pig serum. Some pedants might perhaps say that in spite of this unfortunate connotation of "porcine," it should still be used instead of pig in expressions in which "pig" functions as an adjective, just to keep the proportion of adjectival form in use as high as possible. These same persons, however, would probably not consider changing "body blow" to "corporeal blow." As a matter of fact, in general, changing nouns to adjectives has an effect on the meaning which the proponents of the measure seem to ignore. It adds an attribution, often absent when the modifier is a noun, of the properties of the modifier to the noun modified. Thus "funeral parlor" means simply a parlor for funerals, whereas "funereal parlor" means a parlor which is "sad and solemn; dismal; mournful" (and not necessarily used for funerals). This fact probably partly explains the irritation felt by authors at finding nouns in their manuscript changed to adjectives on the printed page.

The most important point of all, however, seems to be that such changes of ordinary expressions into extraordinary expressions simply add another overtone of the bizarre to what is in too many scientific papers an already somewhat strained and unnatural style. They make it more difficult for the reader to find out what the author is trying to say, and this is often difficult enough, particularly when the subject is not too familiar to the reader. Even if there were some philological reason for wanting the change (which there is not), it would still be desirable to avoid it, since the primary purpose of writing, of scientific writing at least, is to convey something to the reader.

SAUL MALKIEL

BOSTON UNIVERSITY
SCHOOL OF MEDICINE

IN Dr. Boyd's paper published in SCIENCE on August 27, 1943, he stated most effectively the position against "Arbitrary Editorial Changes in Scientific Papers" (or in any other signed papers, for that matter). Dr. Boyd supported his arguments on the basis of: (1) the genius of the English language, citing philologic authority; (2) the preferences of scientific writers; (3) clarity, and (4) the right of an author

[1] SCIENCE, January 21, 1944.
[2] SCIENCE, August 27, 1943.

not to have changes made in his work without his permission.

In his letter of January 21, 1944, E. H. McClelland ignores Dr. Boyd's reasoning and supports his objection to Dr. Boyd's position solely by the statement that "equine serum" is exact and can not be misunderstood, whereas "horse serum" might be interpreted to mean a number of different things.

According to the definition, given in Webster's New International Dictionary, of "equine" when used as an adjective, "equine serum" might mean "serum of a horse," "serum pertaining to a horse," or, God save the mark, "serum resembling a horse."

Incidentally, what would Mr. McClelland prefer to corn whisky?

ROBERT J. LAWTHERS

BOSTON, MASS.

AN article appeared in SCIENCE (January 21, 1944) written by E. H. McClelland, in which he justified the change made by the editor of some journal in a manuscript of Dr. William C. Boyd. Dr. Boyd objected to the change from "horse serum" to "equine serum." Mr. McClelland laments the omission of connectives in English speech which results in nouns modifying nouns and believes this practice is a serious factor in the impairment of the English language. He claims that the change from "horse serum" to "equine serum" not only elevates the words from the dismal category of bad English, but also restores them to the realm of clarity from that of ambiguity.

As grammar is the basis of correct speech, we violate one of its rules by permitting a noun to modify a noun. But since the pattern of language is subject to evolution, is there any reason why a noun may not transmigrate to an adjective?

And as for ambiguity even the dictionary does not claim that "equine" will define serum any more rigorously than "horse," for in Funk and Wagnalls' "New Standard Dicitionary" (unabridged) "equine" means "of, pertaining to, or like a horse," so one has still to make a choice to suit the context.

Also in that dictionary "horse" has done very well as an abortive noun and gallops over more than a page (!) as an adjective.

Perhaps the answer to all the argument is to confer on "horse" a new degree and give him his A.D.J. It is noteworthy that "human" has done as much for himself, so why not bestow a similar honor upon this other noble animal?

All of which may merely serve to evoke equine cachinnations.

ANN O. EDISON

WEST ORANGE, N. J.

IN the discussion of editorial changes in scientific papers started by Dr. William Boyd[1] and continued by E. H. McClelland[2] there is one topic of importance that is hinted at but, it seems to us, not sufficiently emphasized. Leaving aside the merits of the point principally at issue, the use of substantives to modify nouns, we have the question of authorship and responsibility. Is the author responsible for the language employed in the paper, or is the editor responsible? When the reader detects inaccurate statements or faulty grammar in a paper, should he blame the author or should he blame the editor? The position often taken, that the author should determine the content of the paper and the editor the form, is not tenable. Every scientist well knows that the alteration of a single word or the misplacing of a single comma may totally change the meaning of a sentence. There can be no satisfactory division of responsibility unless the editor is willing to make himself the joint author of every paper.

It appears that friction between editors and authors could be avoided if they would govern themselves by the following principles. No editorial alterations, however trifling, shall be made without the consent of of the author. Consent may be given verbally, or by initialing a proof. If the author is furnished with a proof that is not in exact agreement with the copy he shall be privileged to approve it, to insist that it be made to agree with the copy or to withdraw the paper. But if the proof is typographically correct and in exact agreement with the copy, the author shall be bound to approve it without change, if the editor insists.

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SCIENTIFIC BOOKS

VITAMINS AND HORMONES

Vitamins and Hormones. Advances in Research and Applications. Edited by ROBERT S. HARRIS and KENNETH V. THIMANN. Volume I. With a foreword by E. V. MCCOLLUM. 1943. New York: Academic Press, Inc., Publishers. Price, $6.50.

THE present volume of "Vitamins and Hormones" constitutes the beginning of a new periodic publication and is planned to be the first of a succession of yearly volumes, which—in the words of the editors—

[1] SCIENCE, August 27, 1943.
[2] SCIENCE, January 21, 1944.

"will chronicle progress and point the way to new achievements." In his foreword Professor E. V. McCollum rightly points out "that the time is ripe for the founding of such a venture, since it is no longer possible for any one to read sufficient of the current papers and the library files dealing with these two classes of substances to assimilate all the knowledge which has accumulated."

Whereas the "Annual Review of Biochemistry" brings only reviews limited more or less to the publications of one year, giving a very comprehensive picture of this one year's work with the inclusion of vitamins and hormones, the present publication "Vitamins and Hormones" endeavors to interpret the records of many years in their relation to a few special problems. Thus the limitation lies here not in the time element but in the selection of the subjects to be incorporated in the current volume.

The high biological activity is the most conspicuous common link between vitamins and hormones. Hormones as endocrine products contribute in a large, even decisive manner to determining constitutional reactions, within physiological or pathological range. Vitamins introduced in the body with the food have a similar capacity in many respects. Here is a future possible field of research, the opening of which might be facilitated through the intermediary of "Vitamins and Hormones."

In the present first volume the scale is tipped rather in favor of vitamins. Of ten chapters two and part of a third contribution deal with hormones. The extraordinary achievements of the last 10 to 15 years in the chemical research of sex hormones are representatively reviewed by G. Pincus and W. H. Pearlman who wrote on "The Intermediate Metabolism of the Sex Hormones" and by T. Reichstein and C. W. Shoppee, whose subject is "The Hormones of the Adrenal Cortex" with special reference to the chemistry of cortical steroids. Pincus and Pearlman discussed the chemical reactions and transformations of the sex hormones in the body and *in vitro*.

"Physical Methods for the Identification and Assay of Vitamins and Hormones" is the title of the chapter written by J. R. Loofbourow. Spectrophotometry, colorimetry and fluorophotometry are described, analyzed and critically compared. For isolation, identification of the substances in quest, for determination of their purity the spectrophotometric method has its advantage. For assay procedures, so far vitamin A, α- and β-carotene and especially for esterone and androsterone colorimetric methods are just as good or even better than spectrophotometry. In the case of thiamine and riboflavin, fluorophotometry is by far the most sensitive of the assay methods.

The first chapter in the volume was written by C. C. Lucas and C. H. Best. Perhaps on account of his special and therefore biased interest in the subject, the present reviewer feels that this report is in almost every respect beyond possible criticism and was the best possible selection as an introductory contribution. Lucas and Best give a concise, clear and objective résumé of various problems connected with choline as a dietary factor. Choline "should take its place with the other members of the B complex from which it can not now legitimately be separated in any complete consideration of metabolic changes." The interrelation of choline, methionine and cystine is discussed by Lucas and Best in great detail, with special reference to the phenomenon of transmethylation (and dimethylation) as first formulated by du Vigneaud and his group. The questions whether choline and methionine are the only effective lipotropic factors, and whether the lipotropic activity of a protein is sufficiently determined by its relative content of methionine and cystine are left open. With Griffith the anti-lipotropic activity of cystine is considered by Lucas and Best as probably non-specific and due to the raising of the metabolism nearer to the normal level thus resulting in an increased demand for lipotropic factors. The present reviewer is not in agreement with this assumption and is in favor of assigning to cystine a specific role not only with regard to its anti-lipotropic activity but especially with regard to the experimental finding that whereas cystine alone is anti-lipotropic and promotes hepatic injury (necrosis and especially cirrhosis), given in combination with choline it is more beneficial than choline is alone. These and similar problems are now in the center of research activities. Workers engaged in this field should not miss the close study of the excellent report of Lucas and Best.

"The Appraisal of Nutritional States" is reviewed from the point of view of a clinician by N. Jolliffe and R. M. Most. Evidence for the prevalence of malnutrition is adduced from mortality statistics, morbidity rates, dietary surveys and from food supplementation. Under the factors contributing to nutritional failure the most important are intercurrent illnesses of great variety. The recognition of nutritional inadequacy is based on dietary, medical history and on the results of special examinations, using purely clinical and laboratory methods.

The title of the chapter, "The Chemical and Physiological Relationship Between Vitamins and Amino Acids," written by H. H. Mitchell is misleading. This report deals not only with amino acids but also with amino acid derivatives and with proteins as "amino acid aggregates." In consequence, the territory to be covered is too far extended and the views given are seen more from a distance than in their details.

R. P. Hall with his contribution did a real pioneer service summarizing the few available research data on "Growth-Factors for Protozoa." Here is a field which undoubtedly will receive more attention in the years to come.

G. R. Minot and M. B. Strauss in their masterly contribution on the "Physiology of Anti-Pernicious Anemia Material" were able to draw from rich experimental and clinical material of past studies.

In his chapter on "The Significance of the Vitamin Content of Tissues," R. J. Williams introduces the interesting problem of vitamin distribution. Special emphasis is laid on the significance of such distribution with regard to the functioning of the respective vitamins and also to the correlation with respiratory activity of tissues. More data have to be collected before generalization can be made.

The last contribution to be reviewed is that of G. Wald on "The Photoreceptor Function of the Carotenoids and Vitamins A." It is one of the outstanding chapters in the volume and its study should be highly recommended. It gives a lucid, logical exposition of all the available findings as gathered mainly from the research of the author. His conclusion, based on comparative physiology of photoreception, is that all photosynthetic cells appear to contain carotenoids, beginning from carotenes, xanthophylls, through astaxanthin in protistan phototaxis to vitamin A_2 (in fresh-water vertebrates) and finally to vitamin A_1 with active and determining participation in the primary processes of photoreception.

The volume contains a complete and useful subject and author index in addition to the bibliographic references attached to each chapter. (The latter are not handled with complete uniformity throughout the volume).

Workers in the fields of vitamins and hormones will gratefully acknowledge the present first volume of "Vitamins and Hormones" and will wish to the editors, to their contributors and to the publishers success for the future.

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ORGANIC CHEMISTRY

Electronic Interpretations of Organic Chemistry. By ARTHUR EDWARD REMICK. v + 474 pp. 19 figs. 13.8 × 21cm. New York, N. Y.: John Wiley and Sons, Inc. 1943. $4.50.

THE purposes of the book, as stated in the preface, are to review the contributions of physical chemistry to the theory and practice of organic reactions and to teach the organic chemist how to apply the new knowledge in attacking his problems. The task of relating physical properties with structure is not undertaken.

The first four chapters trace the historical development of the electronic concept of chemical bonds and reactions, emphasis being placed on aspects of interest to organic chemists. The long chapter V outlining the electronic theory of the English school of organic chemists contains a clear exposition of the many principles developed for the explanation and prediction of the course of organic reactions. In the sixth chapter the nature of resonance and its significance to organic chemistry is presented with acknowledged indebtedness to Pauling's "Nature of the Chemical Bond." Chapter VII, concerned with contributions of kinetics to organic reactions, describes the Eyring-Polanyi transition-state theory of reactions, Hammett's work on the importance of the entropy factor in the rates of organic reactions and Remick's thermodynamic prediction of reaction mechanism and rates. There follows a chapter on electrochemical studies of organic oxidation-reduction reactions. Chapter IX discusses the characteristics of electron-pairing reactions (a new term for reactions involving free radical intermediates), and a thermodynamic method for estimating quantitatively the products formed. In the penultimate chapter the quantitative and qualitative effect of solvent changes on the thermodynamic possibility and kinetics of organic reactions is elucidated, leaving little doubt of the importance of these matters to organic chemists. The last chapter, brief for one dealing with displacement reactions, reviews the mechanisms of hydrolysis of alkyl halides and carboxylic esters, elimination reactions and olefin addition reactions.

By title and content this book has been written for the large number of organic chemists who desire a working knowledge of modern theories of organic chemistry. Realizing that the complexity of organic molecules makes the application of qualitatively valid concepts of wider use than quantitative estimations, Professor Remick has been careful to designate fundamental principles by number and to summarize them conveniently at the end of the book. These principles are simple to learn but present difficulty in application, overcome only by practice and study of many examples. While the number of examples is greater than that found in the other books on theoretical organic chemistry, the reviewer feels that the progress of an initiate will be impeded by the comparative paucity and simplicity of the examples. Furthermore, the majority of illustrations exemplify the old English idea of mesomerism or electromeric shift. Subsequent discussion of the nature, advan-

tages and applications of resonance is inadequately illustrated, and does not replace the idea of mesomerism by the more general conceptual scheme of resonance.

Somewhat surprising is the omission of the few principles delineating the characteristics and generalizing the behavior of carbonium ion intermediates. Some of the reactions, intelligent understanding of which is made difficult by the omission, are the Wagner-Meerwein rearrangement, the reaction of diazomethane with ketones, the reaction of nitrous acid with primary amines and the Friedel-Crafts reaction. Among other important topics not treated is the work of Lucas and Winstein in which they produce convincing evidence for the bromonium ion intermediate, important in the displacement reaction and mechanism of addition to olefins.

There is at present no single book fulfilling the requirement of organic chemists and since many subjects are well discussed and comprehensively reviewed in Professor Remick's book alone, it is another work of circumscribed organic applicability which will be useful for chemists seriously interested in studying modern theories of organic chemistry.

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REPORTS

WARTIME HEALTH AND EDUCATION[1]

THE decisive contribution of science and technology to the winning of the war is recognized by all. The maximum contribution of science is equally essential in the postwar development of America. A nation free from fear and free from want, a nation which guarantees to its citizens a Bill of Economic Rights, is possible only with continued scientific research and development.

Scientific workers are as widely varied in economic status as the workers in any other field. The term "scientist" describes the $25,000-a-year director of an industrial laboratory as well as the $1,500-a-year laboratory worker in a hospital or school. There has been great variability moreover in wartime changes in the salaries of scientists. Many workers in the field of physics have left their jobs to go into war work, often at a considerably higher salary. But in government and academic science, particularly in the biological branches, scientists have in most cases remained at their pre-war positions, with rigidly fixed pre-war salaries.

It is unfortunate that no adequate data are available on the economic status of scientists; but from the meager information at hand, one can safely conclude that large numbers of American scientists are receiving salaries in the neighborhood of $150–$200 a month, or between $35 and $50 a week.

Even where salaries have increased in the course of the present war, they have been largely offset by increased taxation and the rise in the cost of living. All scientists—not only those in the lower income groups—have a great stake in the quick institution of the complete stabilization program proposed by President Roosevelt. Unless the current trend to inflation is halted, the scientist, along with all other professionals, will be faced with a serious situation which is bound to reduce the effectiveness of his contribution to the nation.

A wartime problem which many scientists face is that of the difficult living conditions in "war-boom" communities. Many scientists from distant parts of the country have been brought to communities where living costs have risen far more than for the country as a whole and where housing facilities are wholly inadequate to meet the new demands.

Scientists, perhaps more than most professional and white collar workers, are involved in war work for which they are paid, directly or indirectly by the Federal Government through such agencies as the Office of Scientific Research and Development and the National Defense Research Council. Unless a proper plan of action is followed by the Federal Government in turning from the wartime to a peacetime economy, there will be disastrous economic dislocations among scientific workers after the war. This would be both a personal and national calamity. As has already been indicated, the maximum contribution of all scientists is as essential to the welfare of the people after victory as it is now.

The American Association of Scientific Workers suggests the following steps, which would help to avert such economic dislocation:

(1) Continuation and expansion of governmental financing of scientific research, through subsidies to universities and other academic institutions as well as through the expansion of the government's scientific and technical agencies. Only by such governmental action can the full scientific skills developed during the course of the war be used.

(2) Continue the activities of the National Roster of Scientific and Specialized Personnel, with increased possibilities of functioning in a broader way, in the selection and placement of scientific personnel after the war.

(3) Those scientists who have left their homes to do

[1] Summary of statement presented to Senate Sub-committee on Wartime Health and Education on January 27, 1944, by Dr. Kirtley F. Mather, president of the American Association of Scientific Workers.

war work in some other part of the country and who wish to return to their original jobs and homes should be considered as drafted men and women returning from service to their country. Every effort should be exerted to make their former jobs available to them. They should be furnished with severance pay sufficient to get them back to their homes and over the initial hard times. This is just as much a national responsibility as that recognized in giving "mustering-out pay" to members of the armed forces.

SPECIAL ARTICLES

CHEMOTHERAPY OF FILARIASIS IN THE COTTON RAT BY ADMINISTRATION OF NEOSTAM

FLORIDA cotton rats are frequently infected with a filarial worm, *Litmosoides carinii*. The adult parasites dwell in the pleural space and microfilariae occur constantly in the peripheral blood of the rats. Since infected animals can be readily procured and since the infection bears some similarity to certain of the human filarial diseases, the cotton rat filariasis appears to supply a much-needed means of testing drugs for potential activity in the treatment or prophylaxis of human filariasis.

Several drugs have been tested in this laboratory for therapeutic action in the cotton rat infection. Among these, neostam (stibamine glucoside, Burroughs Wellcome and Co.) has given particularly favorable results. The adult filarial worms have been killed after a few doses of this drug and gradually thereafter microfilariae have disappeared from the peripheral blood of treated animals.

In Table 1 are given data on ten treated and two control untreated cotton rats. Four doses of neostam, each of from 40 to 60 mgm, were administered intramuscularly to the animals every week until autopsy and microfilaria counts on the tail blood were made almost every day. The animals were autopsied after the intervals indicated in the table and searched for adult worms. In the treated rats presented in the table, in which the microfilaria count finally reached zero, every adult worm was dead when recovered at autopsy. Usually the adult worms from the treated rats were found massed together, often completely enveloped by inflammatory exudate. In other treated rats, besides those shown in the table, which were autopsied before all microfilariae disappeared from the peripheral blood, the adult worms were likewise dead and enveloped by exudate, in some animals after as brief a time as eleven days from the beginning of treatment. It appears from these data that the repeated injection of neostam has resulted in the cure of filariasis in the cotton rat and, since the drug is well tolerated by man in comparatively large doses,[1] its trial in human cases of filariasis seems to be indicated.

TABLE 1

EFFECT OF NEOSTAM ON THE FILARIAL WORM LITOMOSOIDES CARINII IN COTTON RATS

Cotton rat No.	Microfilariae counted in 100 microscope fields × 430 on designated days										Adult worms recovered at autopsy†
	Before treatment	After treatment									
		1	7	14	21	28	35	42	49	56	64	
1	136	94	100	52	20	28	16	7	5	2	0*	40 to 50; dead; matted together.
2	44	0	4	3	5	5	1	3	1	0*		5 to 10; dead; enveloped by exudate.
3	50	28	32	22	24	28	4	1	3	1	0*	10; dead; matted together.
4	4	4	0	0	0	0	0*					1; dead.
5	12	10	0	0	0	0	0*					10; dead; enveloped by exudate.
6	92	62	92	70	38	7	6	6	0	3	0*	50; dead; some matted together.
7	180	152	230	84	16	64	8	3	2	1	0*	50; dead; matted together.
8	92	72	16	4	0	0	0*					25; dead; enveloped by exudate.
9	124	44	56	0	0	0*						20; dead; enveloped by exudate.
10	108	96	116	62	26	5	0*					40; dead; some matted together.
11 (Control)	16	18	36	12	24	20	10	38	48	42	52*	8; living; freely moving.
12 (Control)	252	232	232	176	110	192	90	176	136	186	198*	50; living; freely moving.

* Day of autopsy.
† When worms are matted together, numbers are approximated.
Schedule of treatment: Rats 1 through 7: 40 mgm; Rats 8 through 10; 60 mgm } 4 times weekly until autopsy.
Rats 11 and 12: Untreated controls.

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THE ROLE OF CALCIUM IN CARCINOGENESIS

IN a comprehensive review on the role of the fixed bases in cancer, Shear[1] pointed out that "much con-

[1] L. E. Napier, *Indian Jour. Med. Res.*, 16: 911, 1929.
[1] M. J. Shear, *Am. Jour. Cancer*, 18: 924, 1933.

fusion exists as regards the role in cancer of the commonly occurring constituents, sodium, potassium, calcium and magnesium."

In our integrated program on epidermal methylcholanthrene carcinogenesis in mice quantitative determinations of the fixed alkalies and of iron in normal, in benzene-treated and in methylcholanthrene-treated epidermis have been carried out.[2] These investigations showed that one application of methylcholanthrene reduced within 10 days the epidermal calcium and iron content to 50 per cent. of the normal, benzene alone being without effect. Tri-weekly treatments of the epidermis with the carcinogen for 60 days did not cause a further significant decrease in the calcium content, although the epidermal hyperplasia was more extensive than after a single application at 10 days. The next step was to determine the content of this metal in a carcinoma derived from mouse epidermis. For this purpose a rapidly growing transplantable carcinoma,[3] produced in the skin of a Swiss mouse by methylcholanthrene, was used. The methods for the determination of calcium[4] and for nucleoprotein phosphorus, (N.P.P.) the basis of reference, have been given.[5] For analysis the carcinomas were cleaned of adhering blood and connective tissue after removal and then cut in small pieces and thoroughly mixed before sampling. A small piece of each tumor used for analysis was fixed for microscopic examination to determine the extent of necrotic tissue present.

Since transplantable tumors may contain variable amounts of necrotic tissue and since such necrotic tissue is known to be rich in calcium,[1] it was necessary to exclude as far as possible the presence of necrotic tissue. This was accomplished by using young tumors, 10 to 14 days after inoculation, at which time they are small, solid, and contain little, if any, necrotic material. Six to 12 tumors were required for a single analysis.

The calcium content was determined in nine different samples. The results, together with those of normal, benzene-treated and epidermis, rendered hyperplastic by the carcinogen, are shown in Table 1. The Ca/N.P.P. ratio of hyperplastic epidermis was 50 per cent. less than normal, and that of the carcinoma about 50 per cent. less than the hyperplastic epidermis. The calcium content of the carcinoma varied from 0.007 to 0.014 mg calcium per 100 mg tumor.

With the microincineration technique Paletta, Cowdry and Lischer[6] found demineralization in both benign and methylcholanthrene, hyperplasia, particularly in the distal part of the spinous layer. With the same method Scott[7] reported that hyperkeratosis, warts, human breast and skin carcinomas showed much less calcium and magnesium in their cytoplasm than did similar normal types. However, it is not possible to distinguish between calcium and magnesium by the microincineration technique.

TABLE 1

Tissue	No. of analysis	Mg. calcium per 100 mg tissue average	Mg. nucleoprotein phosphorus per 100 mg tissue	Calcium / Nucleoprotein phosphorus ×10
Normal epidermis	6	0.044	0.118	3.60
Benzene-treated epidermis	7	0.042	0.125	3.40
Methylcholanthrene-treated epidermis (hyperplastic)	18	0.019	0.130	1.46
Carcinoma	9	0.009	0.121	0.75

The extent to which the presence of necrotic tissue affects the calcium content was determined by the analysis of the same strain of transplantable tumor in the groups (Table 2) of older tumors in which necrotic tissue was visible to the naked eye. In Group B, C and D this poorly visible necrosis was verified histologically.

TABLE 2

	Mg Ca per 100 mg tumor Average	Ca/N.P.P. ×10 Average
A. Large necrotic tumors	0.077	
B. Large necrotic tumors freed of gross necrotic material	0.042	3.42
C. Tumors about 15 mm in diameter freed of gross necrotic material	0.029	2.49
D. Tumors about 10 mm in diameter freed of gross necrotic material	0.019	1.61

These results show the effect of including necrotic material in the tissues analyzed and the importance of excluding it in determination of the calcium content of the actual neoplastic tissue.

SUMMARY

Estimations of the calcium content of the mouse epidermis during the process of experimental carcinogenesis reveal two distinct phases: an immediate reduction in the calcium content which persists at a fairly constant level for many weeks and a further reduction when the epithelial cells have been transformed into cancer cells. Reduction of calcium in the

[2] C. Carruthers and V. Suntzeff, *Cancer Res.*, 3: 744, 1943.

[3] The authors are indebted to Dr. Z. K. Cooper of this hospital for the carcinoma.

[4] V. Suntzeff and C. Carruthers, *Cancer Res.*, 3: 431, 1943.

[5] C. Carruthers and V. Suntzeff, *Jour. Nat. Cancer Inst.*, 3: 217, 1942.

[6] F. X. Palletta, E. V. Cowdry and C. E. Lischer, *Cancer Res.*, 1: 942, 1941.

[7] G. H. Scott, *Biological Symposia*, 10: 277, 1943.

hyperplastic epidermis is an important feature in this experimentally induced precancerous condition.

This investigation was aided by grants from the International Cancer Research Foundation and the National Cancer Institute.

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SURVIVAL OF NORMAL CELLS IN PENICILLIN SOLUTIONS LETHAL TO MALIGNANT CELLS

STUDIES at the Wistar Institute of Anatomy and Biology, made possible through the kindness of Dr. M. R. Lewis and Dr. W. H. Lewis,[1] have revealed a selective lethal effect of penicillin upon rat and mouse sarcoma cells, of which a full account will be published later.

In roller tube cultures, untreated sarcoma cells, grown with normal fibroblasts derived from explants of muscle from the same strain of tumor host, grow fully as vigorously as the normal cells. However, upon addition of penicillin (Squibb's sodium salt of penicillin), the sarcoma cells were selectively damaged. With proper choice of the dosage level, it was found possible to kill all the sarcoma cells without damaging the normal fibroblasts. Higher dosage damaged the non-malignant cells, but the dose required was two to three times that required to produce an equivalent injury in malignant cells.

Damage was arbitrarily classified as incipient (granularity of 50 per cent or more of the cells, and a faintly withered appearance of the cell membrane), marked damage (rounding, coagulation or disintegration of the cells, short of 100 per cent), and lethal (no living cells visible). Table 1 shows the totals of

TABLE 1

NUMBERS OF EXPLANTS OF SARCOMA CELLS AND OF NORMAL FIBROBLASTS SHOWING DIFFERENT GRADES OF DAMAGE. COMBINED TOTALS OF ALL EXPERIMENTS.

	None	Incipient	Marked	Lethal	Totals
Normal	112	37	57	0	206
Sarcoma	0	29	156	78	263

explants classified according to damage shown. These results include four induced rat tumors and one induced mouse tumor. Another induced mouse tumor, not included in the data of Table 1, did not show a definite selective response.

In twenty-five experiments, the treated tumor cultures were implanted into rats of the corresponding 100 per cent-susceptible strain. All cultures graded as "lethal damage," and most of those graded as "marked damage" failed to produce tumors, whereas the untreated cultures produced tumors.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A RAPID, QUANTITATIVE METHOD FOR THE DETERMINATION OF PENICILLIN

THE following assay method affords a rapid, convenient and relatively accurate method of determining the potencies of antibiotic substances in terms of suitable standards. Since assays may be completed during the course of a working day, the method is particularly useful as a guide to the time of maximum production of penicillin, for the control of isolation procedures of various antibiotic agents, in the determination of the amount of deterioration and for related problems.

Earlier experiments[1] on the use of filter paper as a matrix to support mold growth led to the development of the present assay method in which the antibiotic substance to be assayed is placed on sterile, absorbent paper discs on the surface of inoculated nutrient agar. The function of the paper is to act as a reservoir from which the antibiotic substance diffuses into the agar where it inhibits the growth of the test organism. This results in a clear zone surrounding the disc. It was found that the diameter of this zone of inhibition is proportional to the amount of antibiotic substance present and, for practical purposes, may be considered a straight-line function of the log concentration.

The following example illustrates the simplicity of the assay. Nutrient agar,[2] approximately pH 7.0, was seeded with *B. subtilis* spore suspension[3] so as to contain approximately 2×10^5 spores per cc and 25 cc portions of this medium were pipetted into 90 mm petri dishes (depth of the agar approximately 4 mm). Four sterile, filter paper discs, diameter 15.3 mm,[4] were evenly spaced upon the agar. By means of a

[1] We are indebted to the Carnegie Institution of Washington Department of Embryology and to the International Cancer Research Foundation, as well as to the Wistar Institute of Anatomy and Biology, for aid in carrying out this work.

[1] M. B. Sherwood, *Jour. Bact.*, 43: *Proc.*, 779, 1942.

[2] G. L. A. Ruehle and C. M. Brewer, *U. S. Dept. of Agriculture Circ.* 198, 1929.

[3] J. W. Foster and H. B. Woodruff, *Jour. Biol. Chem.*, 148: 723, 1943.

[4] Discs were cut from E. and D. No. 615 filter paper with a sharpened cork borer.

4 mm, 24-gauge nichrome wire loop,[5] 2 loopfuls of the undiluted standard (in this case a *P. notatum*[6] filtrate of known potency) were placed upon one disc and, after flaming the loop, a second disc was treated with 2 loopfuls of 1:4 aqueous dilution of the standard filtrate. Similarly, 2 loopfuls of the undiluted unknown (the unfiltered infranatant solution from a growing culture) were placed on the third disc and 2 loopfuls of a 1:4 dilution of the unknown on the fourth disc. Plates were prepared in quadruplicate and incubated immediately after treatment. An incubation period of 5½ hours at 37° C resulted in growth sufficiently heavy to permit measurement of the clear zone of inhibition with a mm rule. The results are given in Table 1.

TABLE 1

DIAMETER OF ZONES OF INHIBITION IN MM

	Standard		Unknown	
	Diluted 1 to 4 or 25 per cent.	Undiluted or 100 per cent.	Diluted 1 to 4 or 25 per cent.	Undiluted or 100 per cent.
Plate I . . .	27.5	32.5	23.5	29.5
Plate II . .	27	31.5	23	28
Plate III . .	26.5	31	24	29
Plate IV . .	27	32	25	30
Sums . .	$108.0 = S_1$	$127.0 = S_2$	$95.5 = U_1$	$116.5 = U_2$

The potency expressed as percentage of the standard may be readily calculated with the aid of the following simple equation[7] in which 2 is the factor for converting to per cent., d is the log of the ratio of the greater dose to the smaller dose (here d = log 4 or 0.602) and the other terms are those indicated in the table.

$$\text{Potency} = \text{antilog}\left(2 + d\,\frac{(U_2+U_1)-(S_2+S_1)}{(U_2-U_1)+(S_2-S_1)}\right)$$

On substituting the data of Table 1, it was found that the unknown was 45 per cent. as potent as the standard.

$$\text{Potency} = \text{antilog}\left(2 + 0.602\left\{\frac{(116.5+95.5)-(127.0+108.0)}{(116.5-95.5)+(127.0-108.0)}\right\}\right)$$

$$\text{Potency} = \text{antilog}\ 1.6538 = 45\%.$$

Using the method of factorial analysis described by Bliss,[8] it was found that the average standard error was 4.3 and that the slope of the line was 8.3.

Illustrating the reproducibility of results, two independent workers assayed two different preparations and found 11 per cent. and 12 per cent. potency for the weaker solution and 80 per cent. and 84 per cent. for the stronger.

In these antibacterial assays, the loop was found to give the same order of accuracy as micropipettes but to afford greater ease of manipulation and to eliminate much washing and sterilization.

Up to the present, experiments have been done with penicillin, clavacin and gliotoxin. *B. subtilis* was found to be a more convenient test organism than *Staph. aureus, E. typhosa,* or *D. pneumoniae* types I, II and III.

Since the response is affected by the temperature and duration of incubation, the volume of the dose, the size of disc, the depth of the agar and the number of *B. subtilis* organisms per plate, these factors must be kept relatively constant. A more complete study of the method, together with data on the above-mentioned variables, will be presented elsewhere.

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[5] Constructed as described in reference 2. The use of short, wide tubes led to more uniform loopfuls of solution.

[6] The authors are indebted to Dr. K. B. Raper, of the Northern Regional Research Laboratory, Peoria, Ill., for cultures of *P. notatum;* to Dr. S. A. Waksman, of the N. J. Agricultural Expt. Station, New Brunswick, N. J., for a culture of *A. clavatus;* and to Dr. J. W. Foster, of Merck and Company, Rahway, N. J., for cultures of *Staph. aureus* and *B. subtilis.*

[7] The equation is derived as follows: The average of the responses for the standard solutions, $\frac{S_2+S_1}{2N}$ (where N represents the number of responses per dose), is subtracted from the average of the responses for the unknown solutions $\frac{U_2+U_1}{2N}$ and the resulting difference is converted into a logarithm by dividing by b_c, the average slope of the two dose-response curves. The antilog of this logarithm is the potency of the unknown in terms of the standard and may be expressed on a percentage basis by multiplying by 100. It is more convenient, however, to carry out this multiplication while the potency ratio is still in logarithmic form by adding it to 2, the logarithm of 100. Combining $\frac{1}{2}\left(\frac{U_2-U_1}{Nd}+\frac{S_2-S_1}{Nd}\right)$, which is the formula for b_c, with the above steps results in the following equation:

$$\text{Potency} = \text{antilog}\left(2+\left[\frac{1}{\frac{1}{2}\left\{\frac{U_2-U_1}{Nd}+\frac{S_2-S_1}{Nd}\right\}}\right]\left[\frac{U_2-U_1}{2N}-\frac{S_2-S_1}{2N}\right]\right)$$

which reduces to the simple expression given in the text.

[8] C. I. Bliss and H. P. Marks, *Quart. Jour. Pharm. Pharmacol.,* 14: 182, 1939.

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